

LIST OF CURRENT CLAIMS

Claims 1-61 (Canceled)

62. (New) A reactor for solid phase continuous polymerisation of polyethylene terephthalate (PET), comprising:

- a casing;
- a feeding line to feed a low molecular weight PET pre-polymers flow into said reactor;
- a gas line to feed, through supply valves, a gas into said reactor;
- a discharging line inferiorly connected to the bottom of the reactor to discharge the polymerised product;
- a circuit connected to the reactor to purify the gas and to recover pre-polymer particles by means of a proper separator;
- wherein, inside said reactor, means are provided to generate a plurality of fluidised stages in series to cause an increase of the intrinsic viscosity (I.V.) of said PET pre-polymers flow.

63. (New) The reactor according to claim 62, wherein said casing of said reactor has a substantially parallelepiped shape and it is horizontally arranged.

64. (New) The reactor according to claim 63, wherein said means comprise a plurality of inferior vertical walls secured to the base of said reactor and a plurality of superior vertical walls secured to the ceiling of said reactor said fluidised stages being generated between said inferior walls.

65. (New) The reactor according to claim 64, wherein said supply valves are in such a number and arranged in such a way as to generate a sufficient gas flow in correspondence with each fluidised stage.

66. (New) The reactor according to claim 65, wherein said supply valves associated to the same fluidised stage are equipped with heating devices suitable for bringing to the

desired temperature an inert gas flowing through the bottom of the reactor in correspondence with each fluidised stage, this way achieving a differentiated heating of said fluidised stages.

67. (New) The reactor according to claim 67, wherein said casing of said reactor has a substantially cylindrical shape and the casing is vertically arranged.

68. (New) The reactor according to claim 67, wherein said means to generate a plurality of fluidised stages comprise a plurality of shelves secured to the internal wall of said casing in correspondence with which said fluidised stages are generated.

69. (New) The reactor according to claim 68, wherein said shelves, provided inside said casing, are secured to said internal wall of said casing so to radially extend up to about the centre line of the chamber created inside said casing.

70. (New) The reactor according to claim 69, wherein said shelves are formed of apertured metal plates.

71. (New) The reactor according to claim 70, wherein said shelves, provided inside said casing, are approximately horizontal.

72. (New) The reactor according to claim 71, wherein that said shelves are alternately arranged so to define an obligatory path inside said reactor for the pre-polymers descending flow.

73. (New) The reactor according to claim 62, wherein said fluidised stages in series number five.

74. (New) The reactor according to claim 62, wherein said feeding line is equipped with a device suitable for regulating the flow-rate of fed amorphous PET pre-polymer and to prevent gas leakage.

75. (New) The reactor according to claim 74, wherein said device is a rotating volumetric distributing apparatus.

76. (New) The reactor according to claim 62, wherein said discharging line is equipped with a device suitable for discharging the PET after solid phase polymerisation and to prevent gas leakage.

77. (New) The reactor according to claim 76, wherein said device is a rotating volumetric distributing apparatus.

78. (New) The reactor according to claim 62, wherein said circuit further comprises a separation device to recover ethylene glycol and oligomers at the liquid state and then to recycle them upstream of the overall PET manufacturing cycle.

79. (New) The reactor according to claim 62, wherein said PET pre-polymers flow has a low initial I.V. value, generally an I.V. value in the range of $0.20 \div 0.45$ dl/g.

80. (New) The reactor according to claim 62, wherein said I.V. increase of said PET pre-polymers flow is in the range of $0.35 \div 0.65$ dl/g.

81. (New) The reactor according to claim 62, wherein said I.V. increase of said PET pre-polymers flow is ≥ 0.06 dl/g.

82. (New) The reactor according to claim 80, wherein said I.V. increase of said PET pre-polymers flow is ≥ 0.20 dl/g.

83. (New) The reactor according to claim 62, wherein said PET pre-polymers flow is a PET sand flow, the sand particle size preferably being in the range $60 \div 300$ μm .

84. (New) The reactor according to claim 83, wherein said PET pre-polymers flow is a PET sand flow, the sand particle size preferably being in the range $100 \div 250$ μm .

85. (New) The reactor according to claim 62, wherein said PET pre-polymers flow fed into the reactor is maintained in said reactor at a temperature in the range $200 \div 235$ °C.

86. (New) The reactor according to claim 85, wherein said PET pre-polymers flow fed into the reactor is maintained in said reactor at a temperature in the range $205 \div 230$ °C.

87. (New) The reactor according to claim 62, wherein said gas is an inert gas.

88. (New) The reactor according to claim 62, wherein said gas flow inside said reactor is directed in cross-flow or in counter-current flow with respect to the flow of the PET granules that pass through said reactor.

89. (New) The reactor according to claim 62, wherein the ratio between the mass of the gas flow that passes through said reactor and the mass of the PET granules in the reactor is > 0.62 .

90. (New) The reactor according to claim 89, wherein the ratio between the mass of the gas flow that passes through said reactor and the mass of the PET granules in the reactor is > 0.9 .

91. (New) The reactor according to claim 62, wherein said gas is an inert gas or air.

92. (New) The reactor according to claim 91, wherein said gas is air with a dew point $< -30^{\circ}\text{C}$.

93. (New) The reactor according to claim 91, wherein said gas is a mixture of gases selected from the group consisting of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is $< 10\%$ by weight.

94. (New) The reactor according to claim 91, wherein said gas is a mixture of gases chosen from the group consisting of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is $< 6\%$ by weight.

95. (New) The reactor according to claim 62, wherein the gas is recycled to the reactor, after having been purified of the organic impurities, until a level of organic impurities \leq 100 p.p.m. by weight (CH_4 equivalent) has been reached.

96. (New) The reactor according to claim 62, wherein the PET granules have an irregular shape with a volume comprised between 0.05 and 10 mm^3 .

97. (New) The reactor according to claim 62, wherein inside said reactor the polyester granules are subjected to a solid phase polycondensation and/or drying and/or crystallisation and/or dealdehydisation.

98. (New) A process for solid phase continuous polymerisation of polyethylene terephthalate (PET), comprising the steps of:

feeding a low molecular weight PET pre-polymers flow into a reactor through a feeding line;

feeding a gas into said reactor through a gas line in cross-flow or in counter-current flow with respect to said PET pre-polymers flow,

carrying out said polymerisation in a plurality of fluidised stages in series generated inside said reactor to cause an increase of the intrinsic viscosity (I.V.) of said PET pre-polymers flow.

99. (New) The process according to claim 98, wherein said polymerisation is carried out in a number of fluidised stages in series of five.

100. (New) The process according to claim 99, wherein said polymerisation is carried out at non-isothermal conditions.

101. (New) The process according to claim 99, wherein said polymerisation is carried out at isothermal conditions.

102. (New) The process according to claim 99, wherein said polymerisation is carried out in a time period of about 2 hours.

103. (New) The process according to claim 98, wherein said PET pre-polymers flow has a low initial I.V. value, generally an I.V. value in the range of $0.20 \div 0.45$ dl/g.

104. (New) The process according to claim 98, wherein said I.V. increase of said PET pre-polymers flow is in the range of $0.35 \div 0.65$ dl/g.

105. (New) The process according to claim 98, wherein said I.V. increase of said PET pre-polymers flow is ≥ 0.06 dl/g.

106. (New) The process according to claim 105, wherein said I.V. increase of said PET pre-polymers flow is ≥ 0.20 dl/g.

107. (New) The process according to claim 98, wherein said PET pre-polymers flow is a PET sand flow, the sand particle size being in the range $60 \div 300$ μm .

108. (New) The process according to claim 107, wherein said PET pre-polymers flow is a PET sand flow, the sand particle size being in the range $100 \div 250$ μm .

109. (New) The process according to claim 98, wherein said PET pre-polymers flow fed into the reactor is maintained in said reactor at a temperature in the range $200 \div 235$ °C.

110. (New) The process according to claim 109, wherein said PET pre-polymers flow fed into the reactor is maintained in said reactor at a temperature in the range $205 \div 230$ °C.

111. (New) The process according to claim 98, wherein said gas is an inert gas.

112. (New) The process according to claim 98, wherein said gas flow inside said reactor is directed in cross-flow or in counter-current flow with respect to the flow of said PET granules that pass through said reactor.

113. (New) The process according to claim 98, wherein the ratio between the mass of the gas flow that passes through the reactor and the mass of the PET granules in the reactor is > 0.62 .

114. (New) The process according to claim 113, wherein the ratio between the mass of the gas flow that passes through the reactor and the mass of the PET granules in the reactor is > 0.9 .

115. (New) The process according to claim 98, wherein said gas is an inert gas or air.

116. (New) The process according to claim 115, wherein said gas is air with a dew point $< -30^{\circ}\text{C}$.

117. (New) The process according to claim 115, wherein said gas is a mixture of gases chosen from the group consisting of one or more of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is $< 10\%$ by weight.

118. (New) The process according to claim 115, wherein said gas is a mixture of gases chosen from the group consisting of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is $< 6\%$ by weight.

119. (New) The process according to claim 98, wherein the gas is recycled to the reactor, after having been purified of the organic impurities, until a level of organic impurities ≤ 100 p.p.m. by weight (CH_4 equivalent) has been reached.

120. (New) The process according to claim 98, wherein the PET granules have an irregular shape with a volume comprised between 0.05 and 10 mm^3 .

121. (New) The process according to claim 98, wherein inside said reactor the polyester granules are subjected to one or more processes selected from the group consisting of solid phase polycondensation, drying, crystallisation and dealdehydisation.

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122. (New) The process according to claim 98, wherein ethylene glycol and oligomers present at the end of said polymerisation are recovered at the liquid state in a separation device provided in a circuit connected to the reactor and then recycled upstream of the overall PET manufacturing cycle.